



FIG. 1

As a background we assume familiarity of the slotted ALOHA ("RA") model,  $S=G \cdot P_{\text{success}}$ , where  $P_{\text{success}}=\exp(-G)$ .

#### Notation

S1 Throughput generated by VSATs with Controlled RA (CRA) allocation  
G1 Load generated by VSATs with CRA allocation  
S2 Throughput generated by VSATs who don't have CRA allocation  
G2 Load generated by VSATs who don't have CRA allocation

#### Relation

S1 =  $G1 \cdot \exp(-G2)$  Transmissions of VSATs with CRA collide with G2 only  
S2 =  $G2 \cdot (1-G1) \cdot \exp(-G2)$  Non-CRA VSAT transmissions collide with both. G1 loads the inbound in a single burst per time/freq-slot manner.  
G2 loads the inbound as in ALOHA - a few bursts may show up in a single time/freq-slot.

#### More notations:

p Fraction of traffic that is sent by VSATs with CRA allocation  
S Total throughput  
P\_scs Prob of success in Slotted ALOHA  
P\_scs\_1 Prob of success for those VSATs with CRA allocation  
P\_scs\_2 Prob of success for those VSATs with no CRA allocation

#### More Relations:

S1 =  $S \cdot p$   
S2 =  $S - S1 = S \cdot (1-p)$   
P\_scs =  $\exp(-G)$ , where G satisfies  $S = G \cdot P_{\text{scs}}$   
P\_scs\_1 =  $\exp(-G2)$ , P\_scs\_2 =  $(1-G1) \cdot \exp(-G2)$ ,  
where G1 and G2 satisfy S1 =  $G1 \cdot P_{\text{scs}_1}$ , and S2 =  $G2 \cdot P_{\text{scs}_2}$   
S2/S1 =  $G2/G1 \cdot P_{\text{scs}_2}/P_{\text{scs}_1} = G2/G1 \cdot (1-G1)$   
therefore  $G2 = S2/S1 \cdot G1/(1-G1)$

Here is a spreadsheet that calculates these formulas for  $p=80\%$

S	For RA		For CRA with proportion of CRA traffic, $p=80\%$				80 0%		Verification through calculating			Avg P_scs
	G	P_scs	S1	S2	G1	G2	P_scs_1	P_scs_2	delta-S1	delta-S2	delta-S	
10.0%	11.2%	89.4%	8.0%	2.0%	8.2%	2.2%	97.8%	89.8%	3.281E-05	8.2E-06	-2.3E-07	96.2%
15.0%	17.9%	83.6%	12.0%	3.0%	12.4%	3.5%	96.5%	84.6%	0.0004916	0.000123	4.73E-05	94.1%
20.0%	25.9%	77.2%	16.0%	4.0%	16.8%	5.1%	95.1%	79.1%	6.722E-05	1.68E-05	3.29E-06	91.9%
25.0%	35.7%	70.0%	20.0%	5.0%	21.4%	6.8%	93.4%	73.5%	0.0003088	7.72E-05	9.95E-06	89.4%
30.0%	48.9%	61.3%	24.0%	6.0%	26.1%	8.8%	91.5%	67.6%	0.000915	0.000229	9.58E-06	86.8%
35.0%	71.7%	48.8%	28.0%	7.0%	31.4%	11.4%	89.2%	61.2%	4.496E-05	1.12E-05	2.4E-06	83.6%
40.0%			32.0%	8.0%	37.0%	14.7%	86.3%	54.4%	0.0004309	0.000108		79.9%
45.0%			36.0%	9.0%	43.7%	19.4%	82.4%	46.4%	0.000133	3.33E-05		75.2%
48.7%			39.0%	9.7%	49.8%	24.6%	78.0%	39.2%	0.0009785	0.000245		70.3%
50.0%			40.0%	10.0%	53.0%	28.2%	75.4%	35.5%	0.0002245	5.61E-05		67.4%

FIG. 2